

II

Chemical
analyses
of

SOILS.

Arkansas
Geological
Survey. —

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Director

A
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MC
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Callis, Prof. Rilldworth, Soils, pp. 1-5.

Manning's soils 6-15

M
MC
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Prairie Goodwin (R. Call) 2, 3, 4, 5,
Prairie Soil, surface Manning, 6
Prairie subsoil, Manning, 10 ✓

St. Francis county, Ridge soil from (H2) p. 1
" " " Surface soil from (H5) p. 2
" " " "Hard Pan" from (H7) p. 3
" " " Manning's Bottom, from (H8) p. 4
" " " "Hard Pan", " (H9) p. 5.

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Timber ore (Fertile)
Timber ore surface, Manning 8; 14.
Timber ore stone Manning 12

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Z

Label No 112

No 3 Ridge Soil St. Francis County.
 A yellow, ochry soil. (Prof. Pillsbury Coll. Collector)

wt cruc + soil = 16.3300 grams.
 " crucible = 15.2906
 " soil used = 1.0394 anhydrous substance.

Water: wt cruc + soil before heating = 16.3300
 " " " after " = 16.2903
 " water = 0.0397

10 wt = 16.2932 } Heated 110°-115°
 20 " = 16.2922 }
 30 " = 16.2903 } Water = 3.82% } 0.9997 = wt soil dried at 110°-115°

Fused with K_2CO_3 and Na_2CO_3 for analysis.

Silica (SiO_2): wt cruc + SiO_2 + fp = 16.0560
 " crucible = 15.2931
 $SiO_2 = 76.30\%$ } " SiO_2 + fp ash = 0.762900
 " " fp ash = 0.000116
 " " fp SiO_2 = 0.762784

Ferric oxide & Alumina: (Fe_2O_3 and Al_2O_3)
 $Al_2O_3 + Fe_2O_3$ } wt. cruc + Fe_2O_3 + Al_2O_3 + fp = 15.4615
 " " " cruc + fp ash = 15.2930
 $= 16.86\%$ } wt Al_2O_3 + Fe_2O_3 = 0.1685

Lime (CaO): wt. crucible + Lime + fp ash = 15.3559
 $CaO = 1.00\%$ } " crucible + fp ash = 15.3459
 " " " " = 0.0100

Magnesia (MgO): wt cruc + fp + $Mg_2P_2O_7$ = 15.32850
 $MgO = 1.22\%$ } " cruc + fp = 15.28968
 " " " $Mg_2P_2O_7$ = 0.03382

Alkalies Bismuth Oxide method:

wt cruc + soil = 16.3249
 " crucible = 15.2867
 wt soil used = 1.0382

wt soil dried at 110°-115° = 0.9986

$K_2O = 0.54\%$ } wt dish + Alk. chlorides = 14.2168
 " " " wt dish = 14.1916
 " " " wt KCl + NaCl = 0.0252

$Na_2O = 0.89\%$ } wt K_2PtCl_6 + crucible = 21.87380
 " " " wt crucible = 21.84585
 " " " " K_2PtCl_6 = 0.02795

wt KCl + NaCl = 0.02520
 wt KCl = 0.00854

wt NaCl = 0.01666

Loss in ignition: wt cruc + soil = 7.3769
 " " " " crucible = 7.3150
 wt soil + cruc before heating = 7.3769
 " " " " after heating = 7.3085
 " " " " water lost } = 0.0405
 " " " " " " " " }
 " " " " " " " " }
 Loss wt in excess of water = 0.0289
 " " " " " " " " } = 1.0214
 " " " " " " " " }
 Loss in ignition excess of water = 2.83%

water = 3.819%

RESULT.

$SiO_2 = 76.30\%$
 $Al_2O_3 + Fe_2O_3 = 16.86\%$
 $CaO = 1.00\%$
 $MgO = 1.22\%$
 $K_2O = 0.54\%$
 $Na_2O = 0.89\%$
 $P_2O_5 = \text{trace}$
 Loss in ignition } = 2.83%
 in excess of water }
 99.64
 water 110°-115° 3.82

Prof. Pillsbury

No. 5. A yellow clay, marked: "Surface soil, Prairie Goodwin, St. Francis county"

(Prof. R. L. Smith Call, collector.)

Analysis:

wt crucible + soil = 16.1781
" crucible = 15.1261
" soil used = 1.0520

Water: } wt cruc + soil b.f.t. = 16.1781
" " " " a.f.t. = 16.1387
water = 3.745% } " " water lost 110-115° = 0.0394
1.0520 = air dry soil
0.0394 = water
1.0126 = soil dried at 110-115°

Loss on ignition: } wt cruc + soil dried at 110-115° = 16.1387
= 5.026% } " " " " after ignition = 16.0878
Loss on ignition excess of water = 0.0509

Fe₂O₃ and Al₂O₃: } after fusion with K₂CO₃ and Na₂CO₃
Fe₂O₃ = 5.60% } wt cruc + Fe₂O₃ + Al₂O₃ f.p. = 15.2980
Al₂O₃ = 11.90% } " " " " " " = 15.12157
" " " " " " } wt Al₂O₃ + Fe₂O₃ = 0.17736
" " " " " " } " Fe₂O₃ = 0.0561
" " " " " " } " Al₂O₃ = 0.1212
wt cruc + Fe₂O₃ f.p. = 15.16920
" " " " " " = 15.1130616
" " " " " " } 0.05614

Lime, (CaO): } wt cruc + CaO + f.p. = 6.3219
= 0.50% } " " " " " " = 6.3168
" " " " " " } " CaO = 0.0051

Magnesia, MgO: } wt cruc + f.p. + Mg₂P₂O₇ = 6.38870
= 0.825% } " " " " " " = 6.31548
" " " " " " } " Mg₂P₂O₇ = 0.02322

Silica, SiO₂: } wt cruc + f.p. + SiO₂ = 7.0850
= 75.26% } " " " " " " = 6.3169
" " " " " " } " SiO₂ = 0.7681

Alkalies: Bi₂O₃ fusion. } wt cruc + soil = 16.1758
" " " " " " = 15.1250
" " " " " " } " soil = 1.0508 in dry

K₂O = 1.037% } wt dish + NaCl + KCl = 14.2212
Na₂O = 0.72% } " " " " " " = 14.1908
" " " " " " } wt NaCl + KCl = 0.0304
" " " " " " } wt KCl = 0.0167
" " " " " " } wt NaCl = 0.0137
wt K₂PtCl₆ + cruc = 21.8744
" " " " " " = 21.8195
" " " " " " } 0.0549
wt Na₂O = 0.6073
" K₂O = 0.0105

Trace. SiO₂ = 75.26%
Fe₂O₃ = 5.60%
Al₂O₃ = 11.90%
CaO = 0.50%
MgO = 0.82%
Na₂O = 0.72%
K₂O = 1.04%
P₂O₅ = trace
Loss on Ignition = 5.02%
100.869%
water 37.4%

Trace of Manganese
Analysis by
J. L. Smith

RWTB

Prof. Manning's Patton soil; surface fertile; Prairie Garden, St. Francis county. (Prof R. Ellsworth Case, collector).

Analysis: wt conc + soil = 16.1514
" conc = 15.1100
" soil = 1.0414 air dry

Water: = 2.11%
wt conc + soil h.f.t. = 16.1514
" " + soil h.f.t. = 16.1294
" water at 110-115° = 0.0220
Soil dried at 110-115° = 1.0194

SiO₂: = 81.616%
wt conc + ff + SiO₂ = 15.9382
" conc + ff = 15.1062
" SiO₂ = 0.8320

Fe₂O₃ and Al₂O₃:
Al₂O₃ = 7.60%
Fe₂O₃ = 2.94%
wt conc + Al₂O₃ + Fe₂O₃ eff = 15.2111
" conc + eff = 15.1036
wt Al₂O₃ + Fe₂O₃ = 0.1075
wt Fe₂O₃ = 0.0300
" Al₂O₃ = 0.0775
wt conc + Fe₂O₃ eff = 15.1269
" " eff = 15.0969
" Fe₂O₃ = 0.0300

Traces, CaO: = 1.147%
wt conc + ff + CaO = 15.4003
" " + ff = 15.0986
" CaO = 0.0117

Magnesia, MgO: = 0.41%
wt conc + Mg₂P₂O₇ eff = 15.5276
" " + ff = 15.5159
" Mg₂P₂O₇ = 0.0117

Alkalies: Bi₂O₃ fusion
K₂O = 1.28%
Na₂O = 0.64%
wt conc + soil = 16.5483
" conc = 15.5191
" soil = 1.0292 air dry
wt dish + alk etc. = 14.2163
" dish = 14.1858
" KCl + NaCl = 0.0325
" KCl = 0.0204
" NaCl = 0.0121
wt K₂PtCl₆ + conc = 27.0502
" conc = 21.9900
" K₂PtCl₆ = 0.0602
Soil 1.0075 dried at 110-115°
K₂O = 0.012889
Na₂O = 0.00642

Losses or Ignition: 3.636%

Have then:

SiO₂ = 81.62%
Fe₂O₃ = 2.94%
Al₂O₃ = 7.60%
CaO = 1.145%
MgO = 0.41%
K₂O = 1.28%
Na₂O = 0.64%
P₂O₅ = trace
Mn = trace
Losses or water = 3.64
Total = 99.28%
Water = 2.11%

Analysis by
R. Ellsworth Case

R. Ellsworth Case

No. 9 "Hard Pan Prairie Goodwin, St. Francis County. (Collected by R. Ellsworth Call)

Analysis: wt cme + soil = 16.1505
 " cme = 15.1064
 " soil = 1.0441 air dried.

Water: wt. cme + soil bght. = 16.1505
 " " + " of " = 16.1358
 " water 110-115 = 0.0147
 = 1.40% Soil dried at 110-115 = 1.0294

Loss on ignition: wt cme + soil bght = 16.1358
 " " after " = 16.1016
 " lost eqt in excess of water. } 0.0342
 = 3.32%

Fusion with alk. Carbonates. (K₂CO₃ & Na₂CO₃)
 wt cme + soil = 16.5389
 " cme = 15.5181
 " soil = 1.0208
 " " dried at 110-115 = 1.0165

SiO₂: wt cme + SiO₂ eff = 15.9495
 " cme + ff = 15.0962
 " SiO₂ = 0.8533
 = 84.04%

Fe₂O₃ & Al₂O₃: wt cme + ff + Fe₂O₃ + Al₂O₃ = 15.1979
 " " + ff = 15.0930
 " Al₂O₃ + Fe₂O₃ = 0.1049
 " Fe₂O₃ = 0.0376
 " Al₂O₃ = 0.0673

Fe₂O₃ = 3.70%
 Al₂O₃ = 6.32%
 wt cme + Fe₂O₃ + ff = 15.12840
 " cme + ff = 15.09078
 " Fe₂O₃ = 0.03762

Lime, CaO: wt cme + CaO eff = 15.0958
 " cme + ff = 15.0923
 " CaO = 0.0035
 = 0.34%

Magnesia, MgO: trace.

Have. Alkalis: wt cme + soil = 16.5357
 " cme = 15.5154
 " soil = 1.0198
 wt soil dried 110-115 = 1.0055 // air dry

K₂O = 0.91%
 Na₂O = 0.7966%
 wt dish + NaCl + KCl = 14.2162
 wt dish = 14.1866
 " KCl + NaCl = 0.0296
 " KCl = 0.0145
 " NaCl = 0.0151
 wt K₂ PtCl₆ + cme = 21.9900
 " cme = 21.9423
 " K₂ PtCl₆ = 0.0477
 K₂O = 0.00916
 Na₂O = 0.00801

Have then: SiO₂ — 84.04%
 Fe₂O₃ — 3.70%
 Al₂O₃ — 6.32%
 CaO — 0.34%
 MgO — trace
 K₂O — 0.91%
 Na₂O — 0.80%
 P₂O₅ — trace
 Mn — trace

Analysed by
 J. H. Smith

Loss on ignition } 3.32%
 excess of water }
 = 99.43%
 at 110-115 water = 1.40%

Ref. B

6

Wm Manning's soil

Leaf No 389. Soil gray coll. marked: No 2

Surface Prairie soil. SE 1/4 of section 3, 4N, 1W.
Col. Wm Manning.

[Wants complete analysis. Nitrogen determined]
note: many little roots through soil ^{to} _{as far as possible}. Very little fruit apparent.

For water ~~cont.~~

	wt @ 110°-115° = 0.9783 grams
	wt air dry = 1.0010 grams
wt C + 388 bfht.	= 19.07345 "
wt C + 388 afht.	= <u>19.05070</u>
Water 2.27%	wt water = <u>0.02275</u>

For P₂O₅
(No eff. with HNO₃)

	wt air dry = 2.0007 grams
	wt @ 110°-115°C = <u>1.9553</u> "
P ₂ O ₅ 0.17%	wt Mg ₂ P ₂ O ₇ = 0.00539 gm
	wt P ₂ O ₅ = 0.00334 "

For Nitrogen

	wt air dry = 5.0000 grams
	wt @ 110°-115°C = <u>4.8865</u> "
	20% HCl Used
	14.448% HCl used up.
	= .02534 gm NH ₃ = 0.02103 gm N
	= 0.43 % N

wt air dry = 0.9172 gm	wt S + NaCl + KCl = 15.8094
wt @ 110°-115°C = 0.8964	wt S = <u>15.7850</u>
	wt KCl + NaCl = 0.0244
	wt KCl = 0.0090
	wt NaCl = <u>0.0154</u>
K ₂ O = .00568 = .63%	wt K ₂ PtCl ₆ = 0.0296 grams
NH ₄ Cl = .00817 = .91	wt KCl =

Standardizing AgNO_3 , HCl & NH_4OH solutions.

S.S. KCl 100% = 1.0004 grams.
 Titr I 10 cc. KCl = — AgNO_3
 II 10 cc. KCl = 71.35 AgNO_3
 1 cc KCl sol. = .01004 gm. KCl = .004755 Cl

$\therefore \text{AgNO}_3$ 1 cc. = .000666 gm. Cl .

S.S. HCl (sol.) 1000 cc — 1 litre.
 1 cc. HCl S.S. = 0.72 NH_4OH S.S.

{ 1 cc. HCl S.S. = .001768 NH_3 grams.
 1 cc. HCl sol. = .003782 gm. HCl

S.S. NH_4OH (sol.) 500 cc. $\frac{1}{2}$ litre.

1 cc NH_4OH = 1.388 HCl S.S.

1 cc NH_4OH = .002455 NH_3 grams

Standardize HCl by precipitation as AgCl .

I 10 cc HCl

wt Cl + AgCl + pp = 7.35550

wt Cl + pp = 7.205916

wt AgCl = 0.14959

Cl =

II 10 cc HCl

Mean AgCl = .14874 gram. | wt Cl + AgCl + pp = 7.68740

wt Cl + pp = 7.539516

HCl = .03782 grams.

wt AgCl = 0.014789

Proportions to use for 5 Grams Soil.

5 Grams Soil

90 cc. H_2SO_4 Conc.

2 Grams. Salicylic acid.

8 Grams Zinc dust add gradually

2.0 gm K_2O

more H_2SO_4 if necessary.

KMnO_4 as usual.

Leaf No 389. Dark grey fine mixed. No 3
 Surface timber soil ordinarily fertile.
 S.E. 1/4 of section 3, 4 N., 1 W. Col. W. Manning.
 Note many roots, of which large ones
 avoided in sampling. More grit than in 388.

For water & alk. wt air dry = 1.0040 grams
 wt @ 110°-115°C = 0.9722
 wt C + 389 left = 19.0758 grams.
 wt C + 389 a/ht = 19.0440 "
 wt water = 0.0318 "
 Water 3.16%

wt B + NaCl + KCl = 14.1887
 wt B = 14.1658
 wt KCl + NaCl = 0.0229
 wt KCl = 0.0096
 wt NaCl = 0.0133
 wt K₂PtCl₆ = 0.0315 gram.-
 wt KCl = 0.0096
 H₂O = 0.0060 = .61%
 H₂O₂ = 0.0070 = .72%

For P₂O₅ wt air dry = 2.00105 gram.
 wt B B = 1.93782
 wt Mg₂P₂O₇ = 0.00599
 wt P₂O₅ = 0.00383
 0.19%

For Nitrogen wt air dry = 5.0000 gram
 H. 8420
 50 cc HCl Taken =
 14.32g used up by NH₃ in soil
 NH₃ = 0.02533 N = 0.02086
 20 cc HCl Taken =
 none used up =
 NH₃ = N =
 Total Nitrogen 0.02086
 Percent = 0.43% N.

58 cc HCl - req^d 25.7 cc NH₄OH =
 ∴ used up. 35.671 cc HCl

50
 35.671 left.
 14.329 cc HCl for NH₃ in soil

Resumé of 389:

Potash	0.61	per Cent.
Soda	0.72	" "
Phosphoric acid	0.19	" "
Nitrogen	0.43	" "
<hr/>		
Water @ 110°-115°C	3.16	per cent.

Lab No 390 - light yellowish soil massed. "105
 Prairie subsoil. know nothing about it.
 SE $\frac{1}{4}$ of section 3, 4 N., 1 W. Coll. W. Manning.
 note: apparently very little pit.

For water & alk. wt air dry = 1.0009 grams
 " d. @ 110-115°C = 0.9742 "
 wt C + 390 b.f.t. = 19.0709 grams
 wt C + 390 a.f.t. = 19.0442 "
 water 2.66%. wt water = 0.0267

Bizulfur

$K_2O = .00625 = 0.64\%$
 $Na_2O = .00827 = 0.84\%$

wt S + KCl + NaCl = 15.8105
 wt S = 15.7850
 wt KCl + NaCl = 0.0255
 wt KCl = 0.0099
 wt NaCl = 0.0156
 wt K_2PtCl_6 = 0.0326 gram
 wt KCl = 0.0099

For P_2O_5

wt air dry = 2.0015 grams
 wt d. @ 110-115°C = 1.9483 "
 wt $mp P_2O_7$ = 0.00429 gram
 wt P_2O_5 = 0.00274
 0.14%

For Nitrogen

wt air dry = 5.0004 grams
 wt d. @ 110-115 = 4.8674 "

Resume of 390

Potash	0.64	per cent.
Soda	0.84	" "
Phosphoric acid	0.14	" "
Nitrogen		" "
Total	<hr/>	
water @ 100°-115°C		2.66%

Lab No 391. Light brown soil marked: "104
 Timber soil sterile. SE $\frac{1}{4}$ of section 3, 4 N,
 1 W. Coll. W^m Manning."
 Note: apparently only little silt.

For water salt. wt air dry = 1.00195 gm
 wt @ 110°-115°C = 0.95365 "
 wt C + 391 left = 21.1468 grams
 wt C + 391 left = 21.0985 "
 Water 4.82% wt water = 0.0483 "

Bi₂O₃ fusion.
 wt D + NaCl + KCl = 15.8224
 wt D = 15.7854
 wt KCl + NaCl = 0.0370
 wt KCl = 0.0132
 wt NaCl = 0.0238
 wt K₂PtCl₆ = 0.0433
 wt KCl = 0.0132

K₂O = 0.0833 = 0.87% of
 Na₂O = 0.01262 = 1.32% of

For P₂O₅
 wt air dry = 2.0007 grams
 wt @ 110°-115°C = 1.9043 "
 wt mp P₂O₅ = 0.00329 gram
 wt P₂O₅ = 0.00210
 0.119.

For Nitroge
 wt air dry = 5.0016 grams
 wt @ 110°-115°C = 4.7606 "

Resumé of 391:

Potash	0.87	per cent
Soda	1.32	" "
Phosphoric acid	0.11	" "
Nitrogen		" "

Water @ 110°-115°C - 4.82 per cent

14

Label No 392. Dark Gray soil marked: "No. 1. Fertile soil. Timber. $\frac{1}{4}$ of section 3, 4 N., 1 W. Call "Manning".

Note: apparently little gpts.

For water alk.

wt air dry = 1.0029 gram.

wt @ 110°-115°C = 0.9684 "

wt C + 392 b.f.t. = 19.6838 grams

wt C + 392 a.f.t. = 19.6493 "

wt water = 0.0345 "

Water 3.44%

Bisulfus'n.

wt S + NaCl + KCl = 17.1844

wt S = 14.1654

wt KCl + NaCl = 0.0190

wt KCl = 0.0077

wt NaCl = 0.0113

wt K_2PtCl_6 = 0.0255 gram.

wt KCl = 0.0077

$K_2O = .00486 = 0.50\%$

$Na_2O = .00599 = 0.61\%$

For P_2O_5

wt air dry = 2.0013 grams

wt @ 110°-115°C = 1.9325 "

wt $Mg_2P_2O_7$ = .00249 gram

wt P_2O_5 = .00159

0.08%

For Nitrogen

wt air dry = 5.0017 grams.

wt @ 110°-115°C = 4.8297 "

Resume of 392

Potash	0.50	per cent
Soda	0.61	" "
Phosphoric acid	0.08	" "
Nitrogen		" "
	<hr/>	
Water @ 110°-115°C	- 3.44	per cent.